UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/008,059	11/13/2001	Achim K. Heibel	SP00-383A	3896

22928 7590 06/10/2004

CORNING INCORPORATED
SP-TI-3-1
CORNING, NY 14831

EXAMINER	
LEUNG, JENNIFER A	

ART UNIT	PAPER NUMBER
1764	

DATE MAILED: 06/10/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/008,059	HEIBEL ET AL.	
	Examiner	Art Unit	
	Jennifer A. Leung	1764	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 March 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *10 and 12-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *10 and 12-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's amendment submitted on February 2, 2004 and applicant's supplemental amendment submitted on March 17, 2004 have been received and carefully considered. Claims 1-9 and 11 are cancelled. Claims 10 and 12-20 remain active.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

2. Claims 10 and 12-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Berglin et al. (US 4,552,748) in view of Dettling et al. (US 4,335,023).

Regarding claims 10, 12-14 and 17, Berglin et al. discloses a method for carrying out a gas/liquid/solid reaction (i.e., a gas-liquid-solid phase reaction using hydrogen gas; column 4, lines 36-46) comprising the step of conveying a liquid or gas/liquid feed stream (i.e., a working solution of anthraquinones with hydrogen gas dissolved therein) through a solid catalyst of honeycomb configuration having, "... parallel channels, to the walls of which the catalytically

active material has been applied," (column 5, lines 13-19; also column 4, lines 53-60), to achieve catalytic conversion of the liquid (i.e., hydrogenation of anthraquinone to anthrahydroquinone; column 1, lines 21-35). The solid catalyst may be formed according to a variety of structural configurations (column 4, lines 47-column 5, line 21). For example,

> "The catalyst body preferably is built up of alternately planar and corrugated layers forming bundles of parallel channels, but *other embodiments* may also be used."
>
> "... the catalyst body may be built up of a solid, preferably inert structure to the walls of which the hydrogenation catalyst is fixed in the form of a thin layer. The catalyst may be applied to the structure by means of a porous carrier."

In general, the requirements for the solid catalyst are that the catalyst body comprise,

> "... a coherent structure which consists of a multiplicity of parallel through channels, the open diameter of said channels being for example 0.5 - 10 mm, preferably 1 - 2 mm. The wall thickness of the structure may lie between about 0.03 and 1 mm, preferably between 0.1 and 0.3 mm." (column 5, lines 7-19).

Berglin et al. further discloses that such solid catalysts have been used in the past in other applications, such as the purification of automobile exhaust gas, wherein,

> "... use can be made of small volumes of so-called monolithic catalysts to avoid the large pressure drops and clogging problems which are encountered with other types of fixed bed catalysts, for example pellets." (column 4, lines 29-35).

Berglin et al., however, is silent as to the parallel channels of the solid catalyst having a cross-sectional shape that is, "free of angled corners and free of curvatures having curvature radii below 10% of the average channel diameter."

Dettling et al. (Abstract; FIG. 1, 1A-C; column 3, lines 1-31, 53-66; column 7, lines 8-52) teaches a solid catalyst of honeycomb configuration**10** comprising a plurality of parallel channels **16**, to the walls **18** of which catalytically active material **22** is applied. Additionally, the cross-

sectional shape of the channels **16** is such that the corners of the channels are "filleted" or "rounded", thereby being free of angled corners and curvature radii below 10% of the average channel diameter. In particular,

> "... the more acute the angle which is formed by the juncture of adjacent walls, the more aggravated is the problem of the formation of excessively thick or deep pockets of coating material in the corners formed by the juncture," (column 8, lines 58-63).
>
> "This renders a small but significant percentage of the coating and/or catalytic material inaccessible to the fluid to be treated, thereby resulting in a general inefficiency and waste," (column 3, lines 14-17).

The "filleted" or "rounded" corners, however, improve over the prior art by,

> "... prevent[ing] the 'burying' of catalytic material too deeply to be effective in connection with treating gases (or liquids) flowed through the flow channels," (column 20, lines 16-49).

The Dettling et al. catalyst is,

> "... particularly adapted to provide a support suitable for the treatment of automotive exhaust gases, although it will be appreciated that it is *not necessarily limited thereto* but is generally suitable for catalytic contacting of fluids, such as, for example, catalytic treatment of gases including pollution abatement, *catalytic processing*, and catalytic combustion of fuels." (column 1, lines 6-20).

Thus, it would have been obvious for one of ordinary skill in the art at the time the invention was made to modify the channels in the solid catalyst in the method of Berglin et al., such that the channels comprised a cross-sectional shape "free of angled corners and free of curvatures having curvature radii below 10 % of the average channel diameter", because filleted or rounded corners in the catalytic channels minimizes the burying of the catalytic material too deeply into the channel wall junctures to be effective can be avoided, as taught by Dettling et al. Furthermore, the substitution of known equivalent structures (i.e., such as the so-called

monolithic catalysts used in the prior art; Berglin et al., column 4, lines 29-35) involves only ordinary skill in the art. *In re Fout* 213 USPQ 532 (CCPA 1982); *In re Susi* 169 USPQ 423 (CCPA 1971); *In re Siebentritt* 152 USPQ 618 (CCPA 1967); *In re Ruff* 118 USPQ 343 (CCPA 1958). The solid catalyst of Dettling et al. meets the requirements of the solid catalyst as suggested by Berglin et al., since the Dettling et al. catalyst, too, comprises a coherent structure having a multiplicity of parallel through channels, wherein the channels have a channel density of, "about 2.5 to 186 channels per square centimeter of end face surface area," (i.e., which lies within the channel open diameter range of Berglin et al.), and wherein the channel walls of structure have a "minimum thickness of about 0.1 millimeters," (column 4, lines 26-44).

Regarding claim 15, although not expressly stated, the hydrogenation of anthraquinone is *inherently* conducted under conditions of a liquid linear velocity of between approximately 0.01 and 100 cm/s, as evidenced by Test B (column 9), since "the circulation flow in the reactor loop through the catalyst fixed bed according to the invention was held at a level as high as 300 liters/min" for a fixed bed catalyst having a diameter of approximately 80 mm and a volume of 1 liter (i.e., take the volumetric flow rate and divide by the surface area of the fixed catalyst bed). See also Test B (column 11) for a volumetric flow rate of about 300 liters/hour for a fixed catalyst bed having a diameter of 80 mm. See also Test B (column 13) for a volumetric flow rate of about 12 m^3/hour for a fixed catalyst bed having a diameter of 0.92 m. [Note: see Bengtsson '043, cited in prior prosecution, for a full teaching of the gas-liquid flow principle].

Regarding claim 16, although not expressly stated, the hydrogenation of anthraquinone is *inherently* conducted under conditions wherein the feed has a gas-to-liquid volume ratio of between approximately 0 and 1000, as evidenced by the, "... strong flow of hydrogen gas

bubbles introduced at the bottom of the bed, whereby the working solution is transported in the direction of the rising bubbles (the mammoth pump principle)," (column 6, lines 4-24), thereby indicating a two-phase gas-liquid flow regime that is not entirely gaseous in phase (i.e., a ratio approaching 1000) nor entirely liquid in phase (i.e., a ratio approaching 0). [Note: see Bengtsson '043, cited in prior prosecution, for a full teaching of the gas-liquid flow principle].

Regarding claims 18 and 19, the same comments with respect to Berglin et al. and Dettling et al. in claims 10 and 17, above, apply. Furthermore, the hydrogenation of anthraquinone is by definition a gas-liquid mass-transfer process, i.e., absorption, since the hydrogen gas is "absorbed" or consumed by the anthraquinone solution to form anthrahydroquinone. Berglin et al. further discloses that, "Since it is the hydrogen dissolved in the working solution which reacts on the active catalyst seats, an efficient *transfer of the gaseous hydrogen from the bubbles to the hydrogen dissolved in the working solution* is of great importance to the utilization of the catalyst, especially since the catalyst is extremely active," (column 3, lines 21-27). Thus the mass-transfer process involves the transfer of hydrogen gas to and from the catalyst surface through the liquid phase.

Regarding claim 20, the same comments with respect Berglin et al. and Dettling et al. in claims 10, 15 and 16, above, apply.

3. Claims 10, 12-14, 17 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzumura et al. (JP 58-096685) in view of Dettling et al. (US 4,335,023).

Suzumura et al. (Figures; Abstract) disclose a method for carrying out a liquid/solid reaction or gas/liquid/solid reaction or gas/liquid mass transfer process (i.e., a gas/liquid/catalyst hydrogenation or hydrotreating process) comprising the step of conveying a liquid or gas/liquid

feed stream (i.e., liquid oil and hydrogen gas, introduced via line **3**) through a solid catalyst of honeycomb configuration (i.e., catalyst layers **1**) comprising a plurality of parallel channels bounded by catalytically active walls traversing the catalyst from inlet to outlet thereof to achieve catalytic conversion of the liquid oil (see FIG. 2a-2d). However, Suzumura et al. is silent as to the cross-sectional shape of the channels being, "free of angled corners and free of curvatures having curvature radii below 10% of the average channel diameter." The same comments with respect to Dettling et al. apply (see above). Therefore, it would have been obvious for one of ordinary skill in the art at the time the invention was made to modify the method of Suzumura et al., such that the gas/liquid feed stream was conveyed through a solid catalyst of honeycomb configuration without angled corners or curvature radii below 10% of the average channel diameter, because a honeycomb catalyst support member configured with filleted or rounded corners, as taught by Dettling et al., "prevents the 'burying' of catalytic material too deeply to be effective in connection with treating gases (or liquids) flowed through the flow channels," (column 20, lines 16-49).

Response to Arguments

4. Applicant's arguments filed February 2, 2004 with respect to the rejection of claims 10-14, 17 and 18 under 35 U.S.C. 103(a) as being unpatentable over Suzumura in view of Dettling have been fully considered but they are not persuasive. On page 7 (first through fourth paragraphs), Applicants argue,

> "The "burying" of catalyst in conventional catalyzed honeycombs does not entail any reduction whatever in the surface activity of the "unburied" catalyst; the entire catalyzed channel surface of such honeycombs, including the catalyst corner sections, remain active and available. The sole reason for minimizing catalyst "buying" in accordance with Dettling is simply to avoid the cost of applying extra catalyst that is not used. Therefore,

> *there is simply no basis in the references for expecting the Dettling catalysts to have any higher activity than conventional catalysts*, either for the gas phase reactions which are the focus of the Dettling disclosure or for the liquid phase reactions of Suzumura."
>
> "... *enhanced conversion efficiencies in liquid phase reactions conducted in rounded channel honeycombs is entirely unexpected* from the combined teachings of Suzumura and Dettling."

The Examiner respectfully disagrees and asserts that the "unexpected results" of enhanced conversion efficiency and higher activity attributed to the rounded channels as claimed by Applicants would have been known and expected by one having ordinary skill in the art. To evidence this concept, Berglin et al. (column 5, lines 48-63) states,

> "It is known that the catalytically active metal preferably should be *located in the outer layer of the catalyst structure* where it can be utilized more efficiently. Thus, British Patent Specification No. 1,267,794 discloses a spherical shell catalyst for use in connection with fixed be hydrogenation of anthraquinones."

Now, referring to page 2, lines 34-86, of the cited British patent to Keith et al.,

> "One serious difficulty with [noble metal] catalysts resides in the fact that the palladium, which is deposited on the crushed aggregate support, has a tendency to *preferentially deposit as relatively thick layers in the cracks and crevices* of the crushed aggregate support, rather than depositing as a coating of uniform thickness over the external surface of the crushed aggregate particles."
>
> "Since much of the palladium deposited on the crushed aggregate supports is covered by other palladium metal in the form of relatively large crystallites, *all of the metal is not available for catalytic reaction*."
>
> "*Furthermore, when operating a fixed bed using a liquid and a gas flowing cocurrently through the bed, the working solution has a tendency to fill the remaining space available in cracks and crevices with liquid, due to the surface tension of the liquid, thereby giving poor gas and liquid distribution in the catalytic bed*."
>
> "All of these factors tend to *reduce the efficiency* of a catalyst using a crushed aggregate carrier for the desired hydrogenation reaction."

Keith et al. then overcomes the above coating problems by providing a spherical catalyst support having pores of small diameter, thereby reducing the presence of cracks and crevices associated with the prior art crushed aggregates and enabling a uniform coating of catalyst material (page 2, lines 87-129).

Similarly to Keith et al., the Dettling et al. reference (see remarks made in claims above) describes various problems associated with the inefficient deposition of excessively thick or deep pockets of coating material in the corner junctures in the channels of a monolithic catalyst. Dettling et al. overcomes the above coating problems by providing a monolithic catalyst having channels with filleted or rounded corner junctures, thereby reducing the presence of crevices associated with the prior art monolithic catalysts and enabling a uniform coating of catalyst material on the walls of the channels. Both Keith et al. and Dettling et al. seek to solve the same prior art problem of producing a uniform catalyst layer and both appear to overcome the problem by reducing the presence of cracks and crevices on the support.

Thus, in addition to a more cost efficient use of a given amount of catalyst material for a given volume of a catalyst support, as expressly taught by Dettling et al. above, the conversion efficiency of a liquid phase conveyed through the catalyst channels of Dettling et al. would also *inherently* be enhanced, by virtue of the minimization of "remaining space available in cracks and crevices" that tend to fill with the liquid phase due to surface tension and cause poor gas and liquid distribution.

The method of Suzumura et al., as modified by Dettling et al., would therefore exhibit enhanced conversion efficiency in the liquid phase upon passage through the rounded honeycomb channels, and such result would not be unexpected.

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

* * *

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer A. Leung whose telephone number is (571) 272-1449. The examiner can normally be reached on 8:30 am - 5:30 pm M-F, every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn A. Caldarola can be reached on (571) 272-1444. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jennifer A. Leung
May 26, 2004 JAL

Hien Tran

HIEN TRAN
PRIMARY EXAMINER